ABSTRACT

[0070] Disclosed is a motor that includes: a stator containing a first winding and a second winding driven by alternating currents; a rotor arranged to rotate relative to the stator, the rotor containing a third winding and a fourth winding, the third and fourth windings of the rotor generating a magnetic field having an amplitude and a phase angle relative to the alternating currents in the first and second windings of the stator; and a circuit in communication with the third and fourth windings for controlling the phase angle of the rotor generated magnetic field and generating a rotating magnetic field that is in phase-lock with the alternating currents in the first and second windings of the stator. Also disclosed is a generator that includes: a stator containing a first winding and a second winding driven by an alternating current; a rotor arranged to rotate relative to the stator, the rotor containing a third winding and a fourth winding, the rotor generating a magnetic field having an amplitude and a phase angle relative to the alternating current; and a circuit in communication with the third and fourth windings for controlling the phase angle of the generated magnetic field and generating a rotating magnetic field that is in phase-lock with the alternating current; wherein at least one of the first and second stator windings outputs alternating current. Also disclosed is a rotor arranged to rotate relative to a stator, the stator containing a first winding driven by an alternating current. The rotor includes: a second winding for generating a magnetic field having an amplitude and a phase angle relative to the alternating current; and a circuit in communication with the second winding for supplying power to the second winding and generating a rotating magnetic field. Also disclosed is a control circuit for measuring a phase of a stator containing a stator winding and an angular position and velocity of a rotor containing a rotor winding, the rotor rotating relative to the stator and the rotor winding generating a flux vector, the control circuit driving the rotor flux vector to remain in a locked phase relationship with an alternating current phase of the stator. The control circuit includes: an angular position feedback device for measuring an angular velocity and position of the rotor; and a comparator in communication with the angular position feedback device for comparing an actual rotor speed and a desired rotor speed and varying the magnitude

of the rotor winding generated flux vector and minimize the difference. Also disclosed is a method of controlling a motor including a rotor containing a winding and a stator containing a winding that includes simultaneously controlling a stator and a rotor arranged to rotate relative to the stator; measuring a torque ripple generated by the motor; and correcting the torque ripple.